Neurological Surgery Milestones

The Accreditation Council for Graduate Medical Education

ACGME

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Neurological Surgery Milestones

The Milestones are designed only for use in evaluation of residents in the context of their participation in ACGME-accredited residency programs. The Milestones provide a framework for the assessment of the development of the resident in key dimensions of the elements of physician competency in a specialty or subspecialty. They neither represent the entirety of the dimensions of the six domains of physician competency, nor are they designed to be relevant in any other context.

Neurological Surgery Milestones

Chair: Nathan R. Selden, MD, PhD

Work Group

Aviva Abosch, MD
Nicholas Bambakidis, MD
Nicholas Barbaro, MD
Frederick A. Boop, MD
Charles Branch, MD
Richard W. Byrne, MD
Ennio Antonio Chiocca, MD
E. Sander Connolly Jr., MD
Laura Edgar, EdD, CAE
Steven L. Giannotta, MD
Michael Haglund, MD
Stanley Hamstra, PhD
Robert E. Harbaugh, MD
Griff Harsh, MD
Carl Heilman, MD
Nickalus R. Khan, MD
Jack Knightly, MD
Doug Kondziolka, MD
Timothy B. Mapstone, MD
Harry Rosenbluth, MBA
Oren Sagher, MD
Warren Selman, MD
Shelly Timmons, MD
Greg Zipfel, MD

Understanding Milestone Levels and Reporting

This document presents the Milestones, which programs use in a semi-annual review of resident performance, and then report to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME Competencies organized in a developmental framework. The narrative descriptions are targets for resident performance throughout their educational program.

Milestones are arranged into levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert resident in the specialty or subspecialty. For each reporting period, the Clinical Competency Committee will review the completed evaluations to select the milestone levels that best describe each learner's current performance, abilities, and attributes for each subcompetency.

These levels do not correspond with post-graduate year of education. Depending on previous experience, a junior resident may achieve higher levels early in his/her educational program just as a senior resident may be at a lower level later in his/her educational program. There is no predetermined timing for a resident to attain any particular level. Residents may also regress in achievement of their milestones. This may happen for many reasons, such as over scoring in a previous review, a disjointed experience in a particular procedure, or a significant act by the resident.

Selection of a level implies the resident substantially demonstrates the milestones in that level, as well as those in lower levels (see the diagram on page iv).

Additional Notes

Level 4 is designed as a graduation *goal* but *does not* represent a graduation *requirement*. Making decisions about readiness for graduation and unsupervised practice is the purview of the program director. Furthermore, Milestones 2.0 include revisions and changes that preclude using Milestones as a sole assessment in high-stakes decisions (i.e., determination of eligibility for certification or credentialing). Level 5 is designed to represent an expert resident/fellow whose achievements in a subcompetency are greater than the expectation. Milestones are primarily designed for formative, developmental purposes to support continuous quality improvement for individual learners, education programs, and the specialty. The ACGME and its partners will continue to evaluate and perform research on the Milestones to assess their impact and value.

Examples are provided for some milestones within this document. Please note: the examples are not the required element or outcome; they are provided as a way to share the intent of the element.

Some milestone descriptions include statements about performing independently. These activities must occur in conformity to ACGME supervision guidelines as described in the Program Requirements, as well as to institutional and program policies. For example, a resident who performs a procedure independently must, at a minimum, be supervised through oversight.

A Supplemental Guide is also available to provide the intent of each subcompetency, examples for each level, assessment methods or tools, and other available resources. The Supplemental Guide, like examples contained within the Milestones, is designed only to assist the program director and Clinical Competency Committee, and is not meant to demonstrate any required element or outcome.

Additional resources are available in the Milestones section of the ACGME website. Follow the links under “What We Do” at www.acgme.org.

Below is an example Set of Milestones for one sub-competency in the same format as the ACGME Report Worksheet. For each reporting period, a resident's performance within each sub-competency will be indicated by selecting the level that best describes that resident's performance in relation to those milestones.

Medical Knowledge 2: Critical Thinking for Diagnosis and Therapy				
Level 1	Level 2	Level 3	Level 4	Level 5
Lists a differential diagnosis for common clinical presentations Lists therapeutic options for common clinical presentations	Provides a comprehensive differential diagnosis for a wide range of clinical presentations Explains advantages and drawbacks of standard therapeutic options	Provides a focused differential diagnosis based on individual patient presentation Justifies optimal therapeutic option based on individual patient presentation	Interprets anomalous presentations and rare disorders Adapts therapeutic choice to anomalous or rare patient presentations	Studies and reports challenging diagnostic presentations Creates new or modifies existing therapeutic options
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐				
Comments:			Not Yet Completed Level 1 ☐ Not Yet Rotated ☐	

Selecting a response box in the middle of a level implies that milestones in that level and in lower levels have been substantially demonstrated.

Selecting a response box on the line in between levels indicates that milestones in lower levels have been substantially demonstrated as well as **some** milestones in the higher level(s).

Patient Care 1: Brain Tumor				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in patients with a brain tumor	Explains the risks and benefits of craniotomy for brain tumor	Formulates a diagnostic and treatment plan for a patient with a brain or spinal cord tumor	Adapts standard treatment plans and techniques to special circumstances (e.g., recurrence, bone marrow suppression)	Leads discussion at an interdisciplinary tumor board
Places an external ventricular drain; assists with set-up, opening, and closing for brain tumor craniotomies	Assists with routine craniotomy for brain tumor	Performs routine craniotomy for brain tumor; assists with complex craniotomy for brain tumor	Performs complex craniotomy for brain tumor; assists with advanced craniotomy for brain tumor	Performs advanced craniotomy for brain tumor
Provides routine peri-operative care for brain tumor patients	Recognizes and initiates work-up of routine complications (e.g., air embolism, CSF fistula, hematoma)	Manages routine complications and recognizes complex complications (e.g., refractory cerebral edema, major vascular injury)	Manages complex complications	Utilizes patient outcome data for quality improvement or the development of adjunctive therapy protocols
☐	☐	☐	☐	☐ ☐ ☐ ☐ ☐
Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Patient Care 2: Surgical Treatment of Epilepsy and Movement Disorders				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in patients with epilepsy or movement disorders	Explains the risks and benefits of functional neurosurgical procedures	Formulates a diagnostic and treatment plan for a patient with epilepsy or a movement disorder	Adapts standard treatment plans and techniques to special circumstances (e.g., Parkinson's plus, multifocal epilepsy)	Leads discussion at an interdisciplinary epilepsy center patient management conference
Performs stereotactic frame placement or frameless navigation registration; assists with set-up, opening, and closing for functional neurosurgical procedures	Assists with routine functional neurosurgical procedures	Performs routine functional neurosurgical procedures; assists with complex functional neurosurgical procedures	Performs complex functional neurosurgical procedures; assists with advanced functional neurosurgical procedures	Performs advanced functional neurosurgical procedures, including interpretation of electrophysiological data
Provides routine peri-operative care for movement disorder and epilepsy patients	Recognizes and initiates work-up of routine complications (e.g., seizures, device infection)	Manages routine complications and recognizes complex complications (e.g., status epilepticus, dystonia)	Manages complex complications	Utilizes patient outcome data for quality improvement; designs care pathways for epilepsy or movement disorder patients
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Comments:

Not Yet Completed Level 1 ☐

Not Yet Rotated ☐

Patient Care 3: Pain and Peripheral Nerve Disorders				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in patients with chronic pain or a peripheral nerve disorder	Explains the risks and benefits of chronic pain and peripheral nerve procedures	Formulates a diagnostic and treatment plan for patients with chronic pain or peripheral nerve disorders	Adapts standard treatment plans and techniques to special circumstances (e.g., cancer pain, deafferentation pain)	Leads discussion at an interdisciplinary case conference or specialty clinic for chronic pain or peripheral nerve disorder patients
Interrogates and programs implanted devices; assists with set-up, opening, and closing for chronic pain and peripheral nerve procedures	Assists with routine chronic pain and peripheral nerve procedures	Performs routine chronic pain and peripheral nerve procedures; assists with complex chronic pain and peripheral nerve procedures	Performs complex chronic pain and peripheral nerve procedures; assists with advanced chronic pain and peripheral nerve procedures	Performs advanced chronic pain and peripheral nerve procedures
Provides routine peri-operative care for chronic pain or peripheral nerve disorder patients	Recognizes and initiates work-up of routine complications (e.g., implanted device failure or infection)	Manages routine complications and recognizes complex complications (e.g., intrathecal drug overdose or withdrawal)	Manages complex complications	Utilizes patient outcome data for quality improvement; designs care pathways for chronic pain or peripheral nerve disorder patients
☐	☐	☐	☐	☐

Comments:

Not Yet Completed Level 1 ☐
Not Yet Rotated ☐

Patient Care 4: Spinal Neurological Surgery				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in patients with degenerative, traumatic, or neoplastic spinal disorders	Explains the risks and benefits of spinal surgery	Formulates a diagnostic and treatment plan for a patient with degenerative, traumatic, or neoplastic spinal disorders	Adapts standard treatment plans and techniques to special circumstances (e.g., spinal deformity, post-irradiated spine, or infection)	Leads discussion at an interdisciplinary spine case conference or specialty clinic
Implements spinal bracing or traction; assists with set-up, opening, and closing for spinal surgery procedures	Assists with routine spinal surgery procedures	Performs routine spinal surgery procedures; assists with complex spinal surgery procedures	Performs complex spinal surgery procedures; assists with advanced spinal surgery and reconstructive procedures	Performs advanced spinal surgery and reconstructive procedures
Provides routine peri-operative care for spinal surgery patients	Recognizes and initiates work-up of routine complications (e.g., pain, surgical site infection)	Manages routine complications and recognizes complex complications (e.g., myelopathy, cerebrospinal fluid (CSF) leak, instrument failure/malposition)	Manages complex complications	Utilizes patient outcome and registry data for quality improvement and treatment selection
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Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Patient Care 5: Vascular Neurological Surgery				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in patients with ischemic or hemorrhagic stroke or vascular neurosurgical disorders	Explains the risks and benefits of vascular neurosurgical and endovascular procedures	Formulates a diagnostic and treatment plan for a patient with ischemic or hemorrhagic stroke or vascular neurosurgical disorders	Adapts standard treatment plans and techniques to special circumstances (e.g., vasculitis, ischemic heart disease)	Leads discussion at an interdisciplinary vascular neurosurgical and endovascular surgery case conference or specialty clinic
Manages and obtains CSF samples from external ventricular drains; assists with set-up, opening, and closing for vascular neurosurgical and endovascular procedures	Assists with routine vascular neurosurgical and endovascular procedures	Performs routine vascular neurosurgical and endovascular procedures; assists with complex vascular neurosurgical and endovascular procedures	Performs complex vascular neurosurgical and endovascular procedures; assists with advanced vascular neurosurgical and endovascular procedures	Performs advanced vascular neurosurgical and endovascular procedures
Provides routine peri-operative care for vascular neurosurgical and endovascular patients	Recognizes and initiates work-up of routine complications (e.g., seizure, hydrocephalus)	Manages routine complications and recognizes complex complications (e.g., cerebral vasospasm, herniation syndrome, intra-operative aneurysm rupture)	Manages complex complications	Utilizes patient outcome data for quality improvement; designs care pathways for vascular neurosurgical and endovascular patients
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Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Patient Care 6: Pediatric Neurological Surgery				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs an age-appropriate history and physical examination with developmental assessment, including for non-accidental trauma	Explains the risks and benefits of pediatric neurosurgical procedures; adapts diagnoses to age-related variations	Formulates a diagnostic and treatment plan for a pediatric patient; determines prognosis in severe brain injury and/or diagnoses brain death in infants and children	Adapts standard treatment plans and techniques to special circumstances (e.g., very young children and infants)	Leads discussion at an interdisciplinary pediatric case conference or specialty clinic; counsels expectant parents regarding fetal anomalies
Performs CSF shunt tap and valve programming; assists with set-up, opening, and closing for pediatric neurosurgical procedures	Assists with routine pediatric neurosurgical procedures	Performs routine pediatric neurosurgical procedures; assists with complex pediatric neurosurgical procedures	Performs complex pediatric neurosurgical procedures; assists with advanced pediatric neurosurgical procedures	Performs advanced pediatric neurosurgical procedures
Provides routine peri-operative care for pediatric neurosurgical patients	Recognizes and initiates work-up of routine complications, including in pre-verbal children (e.g., CSF shunt failure, seizure)	Manages routine complications and recognizes complex complications (e.g., hematoma, CSF leak)	Manages complex complications	Utilizes patient outcome data for quality improvement; designs care pathways for pediatric neurosurgical patients
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Comments:

Not Yet Completed Level 1 ☐
Not Yet Rotated ☐

Patient Care 7: Traumatic Brain Injury (TBI)				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in patients with severe TBI and assigns a Glasgow Coma Scale score	Explains risks and benefits of trauma neurosurgical procedures; evaluates patients with multiple trauma	Selects patients for operative intervention; prioritizes the management of injuries in patients with multiple trauma	Adapts standard treatment plans to special circumstances (e.g., medical co-morbidity, coagulopathy)	Leads discussion at interdisciplinary trauma unit rounds and/or conference
Places an intracranial pressure (ICP) monitor; assists with set-up, opening, and closing for neurotrauma procedures	Assists with routine procedures for patients with TBI	Performs routine procedures for patients with TBI; assists with complex procedures for patients with TBI	Performs complex procedures for patients with TBI; assists with advanced procedures for patients with TBI	Performs advanced procedures for patients with TBI
Provides routine peri-operative care for patients with TBI	Recognizes and initiates work-up of routine complications (e.g., sinus injury, air embolus)	Manages routine complications and recognizes complex complications (e.g., cerebral herniation syndrome, persistent CSF fistula)	Manages complex complications	Utilizes patient outcome data for quality improvement; designs care pathways for neurotrauma patients
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Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Patient Care 8: Critical Care				
Level 1	Level 2	Level 3	Level 4	Level 5
Performs a history and physical examination in critically-ill patients	Manages transient intracranial hypertension (e.g., hyperosmolar agents, CSF drainage)	Manages refractory intracranial hypertension (e.g., cerebral perfusion pressure directed therapy, advanced monitoring, decompressive craniectomy)	Diagnoses and initiates management of acute respiratory distress syndrome	Leads a multidisciplinary neurocritical care team
Inserts arterial and central venous catheters	Assists with routine neurocritical care unit procedures; manages airway and performs endotracheal intubation	Performs routine and assists with complex neurocritical care unit procedures; manages difficult and emergency airways	Performs complex and assists with advanced neurocritical care unit procedures; manages or initiates management of surgical airways	Performs advanced neurocritical care unit procedures; performs bronchoscopy
Manages neurocritical care unit admissions and discharges	Recognizes and initiates work-up of routine systemic complications (e.g., pneumonia, infection, pulmonary embolus, cardiac dysrhythmia, myocardial infarction)	Manages routine systemic complications and prioritizes simultaneous critical clinical events	Manages metabolic and nutritional support for critically-ill patients	Manages complex critically-ill patients (e.g., septic shock, organ failure); designs care pathways for critically-ill patients
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Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Medical Knowledge 1: Information Gathering and Interpretation				
Level 1	Level 2	Level 3	Level 4	Level 5
Correlates normal neuroanatomy and physiology with function Gathers, interprets, and reports basic diagnostic test results (e.g., serology, chest radiograph, brain and spine CT)	Correlates pathological neuroanatomy and physiology with function Describes indications for standard diagnostic testing	Identifies anatomical and temporal patterns of disease occurrence Prioritizes, orders, and interprets diagnostic tests appropriate to clinical urgency and complexity	Interprets unusual variations in patterns of disease occurrence Prioritizes, orders, and interprets complex diagnostic studies (e.g., SPECT, cerebral perfusion, MR tractography)	Effectively teaches anatomic-pathological correlation Utilizes complex diagnostic approaches in novel situations
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Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Medical Knowledge 2: Critical Thinking for Diagnosis and Therapy				
Level 1	Level 2	Level 3	Level 4	Level 5
Lists a differential diagnosis for common clinical presentations Lists therapeutic options for common clinical presentations	Provides a comprehensive differential diagnosis for a wide range of clinical presentations Explains advantages and drawbacks of standard therapeutic options	Provides a focused differential diagnosis based on individual patient presentation Justifies optimal therapeutic option based on individual patient presentation	Interprets anomalous presentations and rare disorders Adapts therapeutic choice to anomalous or rare patient presentations	Studies and reports challenging diagnostic presentations Creates new or modifies existing therapeutic options
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Comments:				Not Yet Completed Level 1 ☐ Not Yet Rotated ☐

Systems-Based Practice 1: Patient Safety				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes principles of patient safety; performs safe and effective hand-offs and transitions of care in routine clinical situations	Recognizes and reports patient safety events; performs safe and effective hand-offs and transitions of care in complex clinical situations	Discloses patient safety events; supervises hand-offs and transitions of care	Analyzes patient safety events and offers error prevention strategies; advocates for safe and effective transitions of care within and across health care systems	Actively engages teams in process and system modification to prevent patient safety events; improves care transition practices within and across health care systems
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Comments:				
Not Yet Completed Level 1 ☐				

Systems-Based Practice 2: Quality Improvement				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes basic quality improvement methods and metrics	Participates in local quality improvement initiatives (e.g., surgical site infection (SSI) reduction, care pathway implementation)	Identifies quality improvement opportunities and assists in the development, implementation, and analysis of a quality improvement project	Advances multiple quality improvement initiatives through participation in a quality improvement working group or committee	Creates, implements, and assesses quality improvement initiatives
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Comments:				
Not Yet Completed Level 1 ☐				

Systems-Based Practice 3: Health Care Systems Awareness				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes principles of US health payment systems	Analyzes how personal practice affects the health care system (e.g. test ordering, length of stay, readmissions)	Seeks information about neurosurgical career options and identifies professional mentor(s)	Prepares for transition to practice (e.g. information technology, risk management, billing and coding, financial, personnel)	Collaborates with nursing and administrative teams to promote high value, quality care within a health care system
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Comments:				
Not Yet Completed Level 1 ☐				

Practice-Based Learning and Improvement 1: Evidence-Based Practice				
Level 1	Level 2	Level 3	Level 4	Level 5
Applies institutional treatment guidelines in basic patient care; identifies and reports complications	Applies published treatment guidelines in standard patient care; tracks personal clinical care outcomes	Critically adapts guideline recommendations to individual patient specifics and preferences; evaluates and applies available outcomes data to improve patient care	Participates in the creation and implementation of institutional guidelines or evidence-based practice protocols; analyzes and reports outcomes data	Promotes evidence-based practice by publishing clinical guidelines and teaching at local or national conferences; participates in clinical outcomes registry design or administration
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Comments:				
Not Yet Completed Level 1 ☐				

Practice-Based Learning and Improvement 2: Research				
Level 1	Level 2	Level 3	Level 4	Level 5
Formulates hypotheses and investigative approaches to clinical or basic scientific problems	Participates effectively in clinical or basic scientific research	Contributes to peer-reviewed clinical or basic scientific literature	Leads a clinical or basic scientific research effort, including application for funding	Receives grant funding for clinical or basic scientific work and makes novel scientific contribution(s)
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Comments:				
Not Yet Completed Level 1 ☐				

Practice-Based Learning and Improvement 3: Mentorship and Teaching				
Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates self-awareness and identifies gaps in knowledge, skills, and experience; incorporates feedback	Teaches medical students, other residents, and patients in informal settings; develops faculty mentorship of self	Teaches health professionals in formal settings (e.g., nursing in-service training, residency teaching conference); mentors medical students	Organizes educational activities at the program level; mentors residents and other health care professionals	Designs and implements clinical rotations, curricula, or learning and assessment tools; models and teaches mentoring to others
☐	☐	☐	☐	☐ ☐ ☐ ☐ ☐
Comments:				Not Yet Completed Level 1 ☐

Professionalism 1: Ethical Behavior				
Level 1	Level 2	Level 3	Level 4	Level 5
Behaves ethically and professionally and takes responsibility for personal conduct	Employs ethical and legal principles (e.g., informed consent, advance directives, confidentiality, error disclosure, resource stewardship) and appropriately seeks advice	Performs tasks in a thorough, timely, and respectful manner in complex or stressful situations and takes ownership of team outcomes	Recognizes, reports, and helps rectify lapses in ethics or professionalism, including coaching others	Promotes ethical and professional behavior by creating a teaching resource, addressing system-level problems, or serving on an ethics panel or Institutional Review Board
☐	☐	☐	☐	☐ ☐ ☐ ☐ ☐
Comments:				
Not Yet Completed Level 1 ☐				

Professionalism 2: Well-Being				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes the importance of personal and professional well-being; manages sleep deprivation and fatigue	Evaluates personal and professional well-being; seeks appropriate personal help and fatigue mitigation when needed	Monitors and attempts to optimize professional well-being of the team; adjusts team assignments to mitigate fatigue and promote wellness	Coaches and assists others in meeting professional expectations; recognizes and responds to physical impairment in self and others	Develops a structured plan or team activity to optimize personal and professional well-being, resilience, and success; participates in a peer support program
☐	☐	☐	☐	☐ ☐ ☐ ☐ ☐
Comments:				
Not Yet Completed Level 1 ☐				

Interpersonal and Communication Skills 1: Patient and Family Communication				
Level 1	Level 2	Level 3	Level 4	Level 5
Uses language and non-verbal behavior to exhibit respect, establish rapport, and demonstrate cultural competency	Establishes therapeutic relationships in straightforward encounters using active listening and clear language	Establishes therapeutic relationships, thoughtfully delivers information, and strives for consensus in challenging patient encounters	Consistently models and mentors others in optimal patient and family communications	Formally teaches communication skills to health care professionals
☐	☐	☐	☐	☐ ☐ ☐ ☐ ☐
Comments:				
Not Yet Completed Level 1 ☐				

Interpersonal and Communication Skills 2: Communication in Coordination of Care				
Level 1	Level 2	Level 3	Level 4	Level 5
Accurately records information in the patient record and safeguards protected health information; coordinates care within the neurosurgical service	Communicates orally and in writing in a respectful, organized, clear, concise and timely manner with all members of the interprofessional health care team; coordinates care with consulting services	Effectively manages complex, team-based clinical care; coordinates care within a hospital system	Models and mentors others in effective communication, including bidirectional feedback and conflict resolution; coordinates long-term care, including rehabilitation	Develops or implements strategies for improving communication and teamwork within a health care system; creates care pathways at the health care system level
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Comments:				
Not Yet Completed Level 1 ☐				

Neurological Surgery Milestones Appendix:

Typical Procedures for Patient Care Milestones

Brain Tumor ……..……..……1

Surgical Treatment of Epilepsy and Movement Disorders……2

Pain and Peripheral Nerve ……..……..…3

Spinal Neurological Surgery……..…4

Vascular Neurological Surgery……..5

Pediatric Neurological Surgery……..……..7

Traumatic Brain Injury ……..……8

Critical Care ……..……..9

Brain Tumor

ROUTINE	COMPLEX	ADVANCED
Resection of a convexity meningioma	Resection of a central parasagittal meningioma	Resection of a petroclival meningioma
Resection of a superficial cerebellar metastasis	Resection of a fourth ventricular ependymoma	Resection of a vestibular schwannoma
Resection of a polar glioma	Resection of a central or eloquent glioma	Resection of a central neurocytoma
Decompress chiasm from pituitary hemorrhage	Resection of an endocrine active pituitary tumor	Resection of a tuberculum sella meningioma
Stereotactic biopsy of a brain mass	Stereotactic biopsy of a brainstem mass	Resection of a third ventricular colloid cyst
Stereotactic radiosurgery of tumor in non-eloquent brain	Stereotactic radiosurgery of a brainstem tumor	Stereotactic radiosurgery of a parasellar tumor

Surgical Treatment of Epilepsy and Movement Disorders

ROUTINE	COMPLEX	ADVANCED
Vagal nerve stimulator implantation	Vagal nerve stimulator lead revision	Responsive neurostimulator (RNS) placement
Stereotactic electrode placement	DBS electrode revision	DBS or lesion placement for non-movement disorders
Subdural electrode placement for epilepsy monitoring	Stereotactic EEG placement	Multi-lobar resective epilepsy surgery
Lesionectomy for epilepsy	Lobectomy for epilepsy	Amygdalohippocampectomy

Pain and Peripheral Nerve

ROUTINE	COMPLEX	ADVANCED
Spinal cord stimulator lead placement	Microvascular decompression	Redo microvascular decompression
Intrathecal catheter and pump placement	Percutaneous trigeminal rhizolysis	Cordotomy
Generator or pump replacement	DREZ procedure	Trigeminal tractotomy
Median or ulnar nerve decompression or transposition	Brachial plexus exploration, neurolysis, or thoracic outlet decompression	Adult or pediatric brachial plexus reconstruction (graft repair or nerve transfer)
Harvest of nerve graft or nerve biopsy (sural, medial antebrachial cutaneous, superficial sensory radial)	Peroneal nerve decompression or ganglion cyst removal	

Spinal Neurological Surgery

ROUTINE	COMPLEX	ADVANCED
Open or MIS lumbar microdiscectomy	Multi-level MIS decompression for stenosis	
Laminectomy for stenosis or abscess		
1 to 2 level ACDF	Corpectomy or 3 to 4 level ACDF	
Posterior cervical foraminotomy	Posterior cervical laminectomy with lateral mass fixation	
Open single level instrumented lumbar decompression	Minimally invasive single level lumbar fusion	Minimally invasive multiple level lumbar fusion
	Ponte osteotomy and instrumentation for simple deformity correction	Occipitocervical or thoraco-lumbar-sacral fusion for deformity correction
		Pedicle or vertebral subtraction osteotomy for complex deformity correction
Laminectomy for extradural lesion	Laminectomy for intradural, extramedullary lesion	Laminectomy for intradural, intramedullary lesion

Vascular Neurological Surgery

ROUTINE	COMPLEX	ADVANCED
Carotid and vertebral diagnostic angiography	Super-selective cerebral angiography with or without infusion of agent	Super-selective intravascular angiography with balloon dilation
	Cervical bifurcation carotid artery angioplasty and stenting	Angioplasty and stenting of intracranial stenosis
Decompressive craniectomy for supratentorial malignant cerebral infarction syndrome with onlay dural graft	Decompressive craniectomy for infratentorial malignant cerebral infarction syndrome with sewn dural graft	Decompressive craniectomy for malignant cerebral infarction in the setting of incompletely reversed coagulopathy
	Endovascular thrombectomy (ICA, M1, BA) for ischemic stroke	Endovascular thrombectomy (M2, P1) for ischemic stroke
Flow diverting stent placement for proximal ICA aneurysm without coils	Coil embolization of aneurysm without balloon or stent assistance	Coil embolization of aneurysm with balloon or stent assistance
Craniotomy for clipping of un-ruptured simple anterior circulation aneurysm	Craniotomy for clipping of ruptured simple or un-ruptured complex anterior circulation aneurysm	Craniotomy for clipping of posterior circulation aneurysm
	Craniotomy for resection of Grade I-II supratentorial arteriovenous malformation	Craniotomy for resection of Grade I-II infratentorial or Grade III-V supratentorial arteriovenous malformation
Diagnostic STA biopsy	Encephaloduroarteriosynangiosis (EDAS)	STA-MCA bypass
Radiosurgical treatment of supratentorial arteriovenous malformation in a single stage	Staged radiosurgical treatment of supratentorial arteriovenous malformation	Radiosurgical treatment of brain stem or spinal arteriovenous malformation
	Endovascular embolization of a meningioma	Endovascular embolization of a cerebral arteriovenous malformation

Craniotomy for evacuation of lobar intracerebral hemorrhage	Craniotomy for minimally invasive evacuation of basal ganglia hemorrhage	Craniotomy for emergent evacuation of lobar intracerebral hemorrhage with simultaneous treatment of a ruptured aneurysm or arteriovenous malformation
	Craniotomy or laminectomy for obliteration of simple dural arteriovenous fistula	Craniotomy or laminectomy for obliteration of complex dural arteriovenous fistula
Craniotomy for resection of non-eloquent cavernous malformation	Craniotomy for resection of eloquent non-brain stem cavernous malformation	Craniotomy for resection of brainstem cavernous malformation
Carotid endarterectomy	Resection of carotid body tumor	Vertebral artery re-implantation

Pediatric Neurological Surgery

ROUTINE	COMPLEX	ADVANCED
EVD or ventriculoperitoneal shunt insertion	Ventriculoperitoneal shunt insertion in a patient under 12 months of age	Endoscopic third ventriculostomy and/or choroid plexus cauterization
Sagittal synostectomy	Cranial vault reconstruction	Fronto-orbital advancement
Small myelomeningocele closure	Complex myelomeningocele closure or simple spinal cord untethering	Complex untethering or lipomyelomeningocele repair
Atretic encephalocele repair	Encephalocele repair	Basal encephalocele repair
Supratentorial lobar tumor or simple posterior fossa tumor resection	Complex posterior fossa tumor resection	Craniopharyngioma, pineal tumor, or combined cerebello-pontine angle and 4th ventricular tumor resection
Chiari I decompression with or without duraplasty in a child over 12 months of age	Chiari I decompression with or without duraplasty in a child less than 12 months of age	Re-do Chiari I decompression with duraplasty and lysis of arachnoid adhesions
Open depressed skull fracture repair with or without brain laceration	Open depressed skull fracture repair with major sinus injury	Spinal fracture repair or spinal deformity reconstruction
Vagus nerve stimulator implantation in a child	Invasive EEG monitoring and resection in a child	Functional hemispherotomy in a child
Surgical treatment of a child with traumatic brain injury		

Traumatic Brain Injury

ROUTINE	COMPLEX	ADVANCED
Parenchymal monitor placement (all types), ventriculostomy catheter, lumbar drain	Repair venous sinus laceration	
Craniotomy for evacuation of traumatic intracranial hematoma	Decompressive craniotomy or craniectomy and duraplasty	Complex cranial incision revision, including skull and scalp reconstruction
Simple or complex skull fracture repair	Craniotomy for skull base reconstruction and repair of persistent CSF leak	Craniotomy for complex craniofacial trauma including injuries of the orbit, zygoma, and frontal sinus
Burr hole drainage of chronic subdural hematoma	Cranial surgery for penetrating injury	
Staged secondary bone flap replacement		

Critical Care

ROUTINE	COMPLEX	ADVANCED
Endotracheal intubation	Tracheostomy	Bronchoscopy
PICC line placement	Vascular dialysis catheter placement	Peritoneal dialysis catheter placement
Cervical traction	Halo fixation	Fluoroscopic reduction of cervical fracture-dislocation
Nasogastric tube placement		Gastrostomy
Pleuracentesis	Chest tube placement	Pericardiocentesis